Air Vehicles News and Accomplishments

January 2007

The X-53 proved Active Aeroelastic Wing Technology in full scale.

Active Aeroelastic Wing flight research vehicle receives X-53 designation

AFRL researchers recently received word that the Active Aeroelastic Wing (AAW) flight demonstrator has been assigned the Mission Design Series number X-53. The designation makes it the first successful X plane initiated within the Air Vehicles Directorate since the X-24 lifting body concept, which was later employed on the Space Shuttle.

The AAW flight demonstrator, a joint effort between AFRL's Air Vehicles Directorate, NASA Dryden and The Boeing Company, is a highly-modified F/A-18 fitted with AAW technology. AAW is a novel wing concept that integrates air vehicle aerodynamics, active controls, and structures to maximize air vehicle performance. AAW technology seeks to use aeroelastic effects, which are normally detrimental to an aircraft's performance, to the benefit of the vehicle.

Traditionally, air vehicles have been designed with stiff geometry in order to minimize aeroelastic instabilities such as aeroelastic control effectiveness. The AAW concept turns aeroelastic flexibility into a net benefit by exploiting the wings' aeroelastic twist. AAW control surfaces control the wing aeroelastic shape at high speeds and maneuver loads at high wing strain conditions to provide large amounts of control power, or can minimize aerodynamic drag at low wing strain conditions.

Receiving the X-53 designation is an important step forward in AAW technology. The X-53 moniker gives the vehicle a higher recognition factor and will likely generate greater interest in the concept from a technology transition perspective.

The AAW concept may play a crucial role in future aircraft, such as future strike unmanned aerial vehicles and global engagement bombers.

AFRL conducts C-130 tip tank flight testing

AFRL, in conjunction with Snow Aviation, recently completed baseline flight testing of a C-130 aircraft.

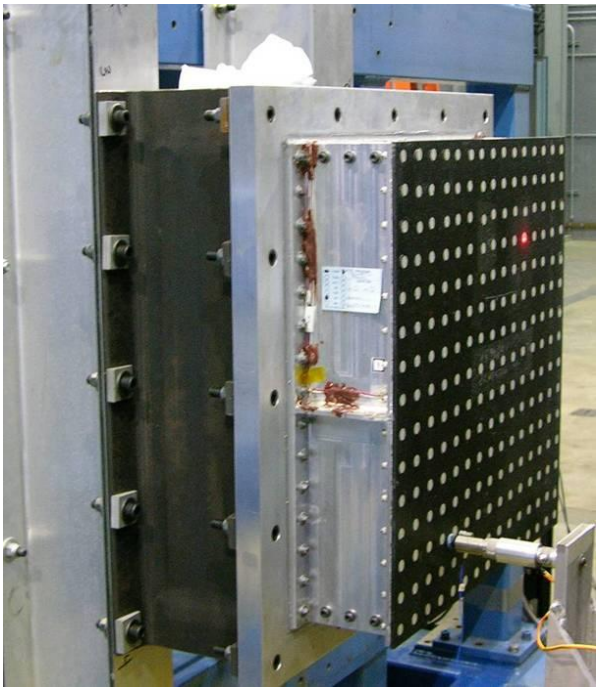
In an effort to determine the aircraft's flight characteristics for future testing, researchers gathered data on the C-130 during different conditions such as maximum performance takeoffs, roll mode at half aileron deflection, banked turns, and power off and power on stalls. Researchers also determined the aircraft's minimum controllable air speed.

The C-130 used by Snow Aviation for the baseline flight tests.

The effort supports Snow Aviation's plans to modify the C-130 with functional tip tanks, replacing the traditional fuel tanks, which are located under the vehicle's wing. The use of tip tanks may help improve aileron effectiveness and reduce the configuration's drag, allowing it to be more fuel efficient. The data gathered from the flight testing will provide a baseline that will be used in comparison with future flight testing data.

The tip tank effort is one in a line of several C-130 modifications by Snow that are designed to improve the aircraft's short take off and landing performance and controllability, but may also have the impact of drag reduction.

AFRL will continue to play an integral role in future C-130 tip tank testing. The next round of flight tests will take place in the coming months. During these tests, researchers will fly a C-130 with tip tanks, using similar methods to gather data for comparison. The data will then be independently assessed by AFRL's Air Vehicles Aerodynamic Configuration Branch to determine the benefits of the modifications.



The thin gage syncore inlet duct panel, recently tested for use on the F-35 Joint Strike Fighter.

AFRL supports F-35 Joint Strike Fighter with acoustic and impact testing

AFRL signed a Commercial Test Agreement with Northrop Grumman Corporation to conduct acoustic fatigue testing of a thin gage composite material with a syncore center structure. The material system was designed for use on the F-35 JSF inlet duct interior walls.

The test article was comprised of a minimum gage composite material with a stiffened syncore material center structure representative of a Short Takeoff and Vertical Landing version of the JSF inlet duct interior wall. The article was mounted to an aluminum box structure to simulate the proper boundary conditions of the airframe. For the test, the test article was subjected to sonic fatigue loading (to simulate pressure fluctuations created from engine noise and air flow through the inlet duct). Impact testing was also conducted to simulate the effects of small impact loads, such as a tool drop and bird strike. The

purpose of this effort was to evaluate the durability and damage tolerance capabilities of this material system in the construction of inlet duct walls.

During the test, the test article was subjected to an accelerated acoustic level at a maximum 166 dB overall sound pressure for four entire lifetimes. Each lifetime consisted of simulated ground run-up and flight operations. After the first lifetime, a 6ft-lb impact test was successfully completed with an impact damage zone slightly larger than the impactor as detected by ultrasonic and thermographic inspections. The second and third lifetimes were completed with no further increase in the impact damage zone, verified by non-destructive inspections. The damage tolerance portion of testing included a larger impact load of 40 ft-lbs. At this load, the impactor only slightly deformed the test panel with no catastrophic failure, a better performance than predicted by the analytical models. Finally, one additional lifetime of acoustic fatigue was complete. Although damage caused by the two impacts began to increase at the impact damage zone, the additional lifetime was completed without catastrophic failure. Data gathered from testing will by used to validate Northrop Grumman's analytical models.

The test fulfilled part of the certification requirements for the inlet duct assembly of the F-35 Air Vehicle Structural Design Criteria. The testing completes one step to field this material system on the future operational JSF.

For more information on any of the stories contained in this report, please contact AFRL/VA Marketing at (937) 255-2074, DSN 785-2074, or email AFRL/VA Marketing.

Air Vehicles News and Accomplishments

February 2007

A Nighthawk micro UAV is being prepared for launch during flight tests at the Muscatatuck Urban Training Center in Indiana.

AFRL conducts Unmanned Aerial Vehicle tests in urban terrain

Air Force Research Laboratory scientists flight tested a group of unmanned aerial vehicles in October, as part of a project to improve capability in an urban environment.

The Cooperative Operations in UrbaN TERrain (COUNTER) project is an effort designed to provide increased situational awareness to warfighters in urban environments, according to program manager Capt. Nidal Jodeh, AFRL Air Vehicles Directorate. "This goal is achieved through the use of small and micro UAVs that perform close range surveillance of obscured urban targets, thereby increasing the probability of

detecting threat objects on the ground," said Capt. Jodeh. "Through the employment of cooperative control algorithms and other automation tools, a single operator can coordinate, command, and control up to five heterogeneous UAVs in an urban environment. "

The COUNTER project's small UAV (SAV), called the BAT-III, operates at higher altitudes, surveying the landscape and nominating potential obscured threat targets for further inspection. A number of micro UAVs (MAVs), called Nighthawks, are then deployed by operators for a closer look at the targets. The Nighthawk MAVs, flying at lower altitudes, are capable of looking underneath obstructions. During the test flights, video telemetry from both the SAV and the MAVs were fed to the Vigilant Spirit Control Station at Muscatatuck Urban Training Center, Indiana, where a ground-based operator monitors and analyzes the data.

This latest round of testing, conducted Oct. 23-26, represents the first large-scale test of the UAVs in an urban environment, said Capt. Jodeh. During the tests, the COUNTER team reached its goal of operating three simultaneous and autonomous coordinated UAVs over the urban terrain to collect video data of specific ground targets.

Operating under Certificates of Authorization from the FAA, which allowed the COUNTER team to perform the flight testing in federal airspace, the researchers launched the SAV at an altitude of 500 feet to collect overall video of the test site's urban environment and target potential threat targets for further inspection. The video from the SAV was collected by the Vigilant Spirit Control Station, where control station operators nominated items of interest for closer inspection by the MAVs.

Two MAVs, operating at altitudes of 175 and 200 feet respectively, then visited the nominated targets. "In the MAV video, the operator successfully detected potential threat items such as simulated weapons and rocket launchers that were placed inside vehicles and underneath outdoor shelters to force the MAVs to fly low and look underneath or inside the obstructions," said Capt. Jodeh.

According to the captain, the UAVs used in the COUNTER project work in close automated coordination, meaning that they will not interfere with each other's surveillance patterns and data transmission. This cooperative control feature distinguishes the COUNTER UAVs from other single, independently operated UAVs.

"COUNTER offers a practical way to deliver real-time video intelligence to the warfighter in an urban environment," said Capt. Jodeh.

The COUNTER team plans to visit the Muscatatuck Urban Training Center again in the spring for further testing. The team is scheduled to participate in Talisman Saber 07, a large-scale U.S.-Australian defense exercise planned for the summer of 2007 in Australia.

The COUNTER test team was comprised of more than 20 personnel from AFRL's Air Vehicles and Human Effectiveness Directorates, Air Force Weather, Indiana Air and Army National Guard, General Dynamics, Applied Research Associates, MLB Corp, and the Department of Defense Counterintelligence Field Activity.

AFRL participates in Supersonic Tailless Air Vehicle testing

AFRL recently provided a full-motion flight simulation environment to test candidate control systems for Northrop Grumman's Supersonic Tailless Air Vehicle (STAV) concept. The testing, conducted in AFRL's

An artist's rendering of the STAV concept vehicle

Large Amplitude Multi-mode Aerospace Research Simulator (LAMARS), incorporated Northrop Grumman's improved design, which included new wind tunnel data, two additional controllers, ground effects and modified landing gear.

During the testing, three of Northrop Grumman's test pilots evaluated the performance of the aircraft during takeoff, landing, subsonic tracking, and supersonic tracking tasks. The pilots used the Cooper-Harper rating scale, a method that assigns quantitative scores against desired and adequate performance criteria, to evaluate the handling qualities of the aircraft during testing. With new modifications, the pilots rated tracking and landing tasks significantly higher over the previous tests conducted in May 2006. The study allowed Northrop Grumman engineers to collect data on over 100 different parameters for more than 300 tests runs. They were also able to look at the effects that auto-throttle played on this concept. The evaluations and data collected during the testing will allow Northrop Grumman to further improve their STAV concept. Northrop Grumman plans to return to the LAMARS testing facility after making further modifications to the design.

The STAV concept is an effort to reduce the weight and drag encountered in traditional supersonic aircraft designs. This reduction is achieved by eliminating the tail and replacing the conventional tail control surfaces with more innovative control effectors.

The BAT-III UAV.

AFRL participates in UAV testing

AFRL recently provided technical and operational support for the Unmanned Aerial Vehicle (UAV) flight testing conducted by The Ohio State University's Collaborative Center of Control Science (CCCS).

During the testing, conducted at Camp Atterbury, Indiana, five successful flights of the BAT-III UAV were completed. The BAT-III UAV is a small, low-cost, autonomous UAV capable of delivering high-quality video telemetry to a ground station. Flight data was gathered for UAV modeling, and UAV operators gained experience in autonomous and manual landings. Operators also gathered imaging data of test targets and tested the experimental ground station. AFRL scientists assisted the flight testing by providing safety and management oversight, the emergency remote control pilot, and general assistance with the overall testing and technical development of the cooperation algorithms yet to be tested.

Additional testing is scheduled for the spring and will include flight tests of multiple UAVs. The CCCS UAV flight testing will help determine the usefulness of UAVs for future intelligence, surveillance, and reconnaissance missions and will help determine the most effective use of UAV resources in a cooperative environment.

For more information on any of the stories contained in this report, please contact AFRL/VA Marketing at (937) 255-2074, DSN 785-2074, or email AFRL/VA Marketing.

Air Vehicles News and Accomplishments

March 2007

Col Michael Leahy presents Mr. James Rudd with the Outstanding Civilian Career Service Award.

Mr. James Rudd retires as Air Vehicles Deputy Director

Mr. James L. Rudd of the Air Vehicles Directorate officially retired from a nearly 40-year career in the Air Force Research Laboratory on January 12. Mr. Doug Bowers, Air Vehicles Associate Director, served as narrator for the ceremony in Foulois Hall, which was filled to capacity with family, friends, and co-workers. Col Michael Leahy, former Air Vehicles Directorate Materiel Group Director and current Vice Director of the 448th Combat Sustainment Wing, offered remarks and presented the awards and certificates.

In his remarks, Col Leahy called Mr. Rudd "a true American hero" and praised his quiet conviction and dedication to the service of his country. He also paid tribute to Mr. Rudd's family saying, "We honor the individual for their contributions, but we know that's not possible without the people behind them."

Following his remarks, Col Leahy presented Mr. Rudd with a variety of awards and honors including the Outstanding Civilian Career Service Award, Department of the Air Force Certificate of Service, a letter from President Bush, and a flag that flew over the U.S. Capitol.

Col Leahy also presented an Air Force Certificate of Appreciation to Mrs. Rudd for her support during Mr. Rudd's long career saying, "Anyone who has given that much time and effort like Jim has to the service of our Air Force and our nation had to have some strong people behind him."

Following the presentations, Mr. Rudd began his remarks by thanking his colleagues, friends, and family for their attendance and support. "I've been very blessed to have worked almost 40 years for the Unites States Air Force," he said. He said he has gotten a tremendous amount of satisfaction over the years from the accomplishments of the people under his leadership.

Mr. Rudd also commented on the friends he made during his years of service saying, "The research is important, but the people are more important." He then thanked the individual members of his family for their help and support.

Mr. Rudd began his career as an in-house researcher and program manager in the Air Force Flight Dynamics Laboratory (now the Air Vehicles Directorate). He served on review teams for aircraft such as the C5-A, B-1B,

C-141, F-16, and KC-135. For 13 years, he conducted research in the areas of durability and damage tolerance.

In 1986, Mr. Rudd began his Air Vehicles supervisory career as the Technical Manager of the Loads and Criteria Group. He then became the Technical Manager of the Fatigue, Fracture, and Reliability Group. His next position was Chief of the Structural Integrity Branch in 1990 and on to Chief of the Structures Division in 1996. In 1998, Mr. Rudd was selected as Chief of the newly-created Aeronautical Sciences Division of the Air Vehicles Directorate, and in 1999 he took over as Deputy Director of Air Vehicles, the position from which he now retires.

During Mr. Rudd's distinguished career, he served as leader of the Wright Laboratory Aging Aircraft Systems Customer Focused Integrated Product Team and the leader of the Air Vehicles Directorate's Personnel Policy Board and Capital Assets Board. He has also served in leadership roles in the American Society of Mechanical Engineers, Society of Automotive Engineers, and the National Management Association.

AFRL completes Mission Adaptive Compliant Wing (MACW) flight test

AFRL researchers recently took another step toward developing adaptive wing technology with a recent series of flight tests conducted at the Scaled Composites, LLC, facilities in the Mojave desert.

The Mission Adaptive Compliant Wing (MACW), developed by FlexSys, Inc., is a flexible structure that enables an aircraft wing to change shape in flight, allowing for less drag and greater aerodynamic efficiency.

According to Pete Flick, MACW Program Manager, the technology represents another step toward developing future aircraft that can sense their aerodynamic environment and airframe response and then adapt to maximize vehicle performance.

The Mission Adaptive Compliant Wing test article, mounted on the White Knight aircraft in preparation for flight testing.

During the MACW flight tests, concluded in early December, a MACW article (a wing section with a compliant trailing edge flap) was mounted on the White Knight aircraft and taken to altitudes of up to 40,000 feet at speeds up to or about Mach .55.

The flight testing built on data collected in a previous wind tunnel test conducted in summer 2006. During the flight testing, the MACW article was observed under actual flight conditions and at higher speeds than during the wind tunnel tests.

According to Flick, one of the characteristics researchers were interested in observing during the flights was the performance of the test article's flaps at colder, high-altitude temperatures. Any stiffening of the MACW article's flaps at cold temperatures would potentially create the need for greater actuation forces to operate the flap. Flick says the flight tests demonstrated that the flap could be used at the designed actuation rate of 30 degrees per second and that the colder temperatures did not produce any significant stiffening of the flaps. The tests also showed that the adaptive flap enabled the wing article to generate a broad range of lift force while still operating at a low drag.

"The flight test data validated the expected performance of the flap from both an aerodynamic efficiency standpoint as well as actuation rate capability," says Flick.

According to Flick, MACW technology could potentially be used for high altitude, long-endurance vehicles such as the SensorCraft concept vehicle. The technology could potentially be employed in commercial aircraft and other non-aircraft applications as well.

Future testing for the MACW involves a structural fatigue test, scheduled for 2007, during which a large-scale flap will be subjected to one to two lifetimes of loading to test its durability. After AFRL's testing is completed, the technology will be ready for a possible transition to a major airframer. Flick says many companies in the airframe industry have expressed strong interest in the technology.

A close-up view of the Calspan Learjet shows the nosecone, modified and fitted with Sense and Avoid electro-optical sensors.

AFRL tests Sense And Avoid (SAA) technology

In an effort to improve the safety and expand the reach of Unmanned Aerial Vehicles (UAV), AFRL recently conducted a series of Sense and Avoid Flight Tests (SAAFT) in Niagara Falls NY. The goal of the latest tests, concluded December 8, was to evaluate the performance of AFRL-developed Sense and Avoid (SAA) components.

The SAAFT program is an effort to demonstrate autonomous collision avoidance of both cooperative and non-cooperative air traffic. According to Vince Raska, Sense and Avoid (SAA) program manager, UAVs currently lack an SAA system capable of avoiding other aircraft when they represent a collision hazard. This lack of SAA prevents UAVs from being allowed to operate freely in the National Airspace System. The SAA program seeks to equip UAVs such as the Global Hawk and Predator with collision avoidance capabilities that would allow them the same access to National and International airspace as manned aircraft.

Two AFRL programs were established to address this need. AFRL's Sensors and Air Vehicles Directorates are working concurrently to develop SAA system components. The Sensors Directorate is developing electro optical (EO) based "sense" or detection sensor technology, and the Air Vehicles Directorate is developing the autonomous "avoid" or maneuvering technology. In addition to the EO system, the Air Vehicles Directorate is also incorporating Traffic Collision Avoidance System (TCAS) information for the detection of conflicting traffic.

The SAA hardware and software was installed in a Calspan Learjet (LJ), which acted as a surrogate Global Hawk UAV. The LJ was flown in various one-on-one encounter scenarios with an FAA Beechcraft King Air and FAA Convair 580 alternately acting as intruder aircraft on a collision course.

A total of fourteen sorties were flown. During each flight, the SAA-equipped LJ encountered anywhere between three and five collision scenarios. In addition to gathering useful data, pilots gained valuable experience in

setting up the “collision” encounters, and even exceeded expectations, says Mr. Raska. The testing also confirmed the ability of the various equipment and sensors to connect and work together.

Following a build-up process, the October flights were performed open loop, with all systems functioning but with the LJ pilot flying the aircraft. The series of flights conducted in December then progressed to closed loop, meaning the SAA system successfully controlled the entire sequence, from detection through avoidance and return-to-course. The EO system and TCAS were first used individually and then together to detect the intruder aircraft.

According to Mr. Raska, the objective of the December flights was to predictably and reliably control the UAV in the same manner as a normally-piloted aircraft. He adds that one of the LJ pilots commented afterward that the avoidance maneuver was performed “just like a (human) pilot would have flown it.” Researchers will use the data recorded during these encounters to generate additional laboratory simulations and further analyze how well the control and avoidance algorithms work.

Further flights were conducted in January 2007, to evaluate the avoidance algorithms capabilities during collision scenarios involving multiple and maneuvering-intruders. An additional system called Automatic Dependent Surveillance Broadcast (ADS-B) will be used for detection, and Infrared (IR) imagery of the encounters will also be recorded for subsequent investigation into the possibility of IR-based detection.

The SAAFT team consists of Northrop Grumman (Integrated Systems), Calspan Corporation, Bihrle Applied Research, C2Projex, Defense Research Associates, AFRL Sensors Directorate, AFRL Air Vehicles Directorate, and through a memorandum of agreement with the FAA, pilots and engineers from the Hughes Flight Test Center in Atlantic City NJ.

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Air Vehicles News and Accomplishments

April 2007

Air Vehicles Directorate participates in Black Engineer of the Year Awards Conference

Scientists from AFRL’s Air Vehicles Directorate recently took part in the Black Engineer of the Year Awards Conference, held February 15-17, in Baltimore.

The Black Engineer of the Year Awards Conference is held annually to recognize the achievements of African-American leaders and to provide opportunities for networking and career advancement.

In addition to the Air Vehicles contingent, representatives from the corporate sector, academia and other government agencies also participated in the conference, providing attendees an opportunity to learn about technological advancements and opportunities throughout an increasingly-diverse workforce.

AFRL's Air Vehicles representatives (left to right) Cari Boos, Don Saunders, and Lt. Emilio Talipan Conference discuss their recruitment efforts with fellow attendee and former Commander of the Air Force Material Command, General Lester Lyles at the 2007 Black Engineer of the Year Awards Conference.

The Black Engineer of the Year Awards Conference seeks to bring together some of the best minds from all walks of society in order to fill an increasing need in today's global economy.

The conference provided Air Vehicles representatives an opportunity to meet with conference attendees, including university professors and students, to make them aware of the directorate's projects and opportunities.

Air Vehicles' mission at the conference was twofold. Representatives sought to meet with quality applicants to increase diversity within the AFRL workforce, and to develop a relationship with traditionally-minority universities to seek out new research opportunities.

To help achieve their goals, the Air Vehicles directorate promoted its 2007 Best Paper Competition, which will award grants for outstanding papers submitted by college students from accredited engineering programs. Through the competition, Air Vehicles representatives seek to form research partnerships and develop working relationships with students in order to promote interest in an AFRL career opportunity.

Air Vehicles representatives included Mark Derriso, Lt Emilio Talipan, Cari Boos, Don Saunders, Elechia Ervin, Thierry Pamphile, and Mike Atkinson. Seana McNeal and Joe Gordon from AFRL's Propulsion Directorate also assisted in the effort.

Structural Health Monitoring tests may aid access to space

Three of the Thermal Protection System test specimens (left) tested in AFRL's Combined Environment Acoustic Chamber (right).

AFRL recently tested a Structural Health Monitoring (SHM) system that may help improve rapid access to space.

The tests are one step toward developing an Operationally Responsive Space (ORS) vehicle, a vehicle that would be capable of launching quickly, returning to Earth, and being launched again within a few hours.

The SHM tests involved a thermal protection system (TPS) test panel, equipped with thermocouples, piezoelectric sensors, acoustic emissions sensors and fiberoptic sensors. The various sensors monitored the structural integrity of the TPS panel while the panel was subjected to temperatures up to 2100 degrees Fahrenheit and acoustic loads up to 165 decibels, simulating a space launch. The testing was conducted in AFRL's Combined Environment Acoustic Chamber, the only facility capable of simulating such extreme environments.

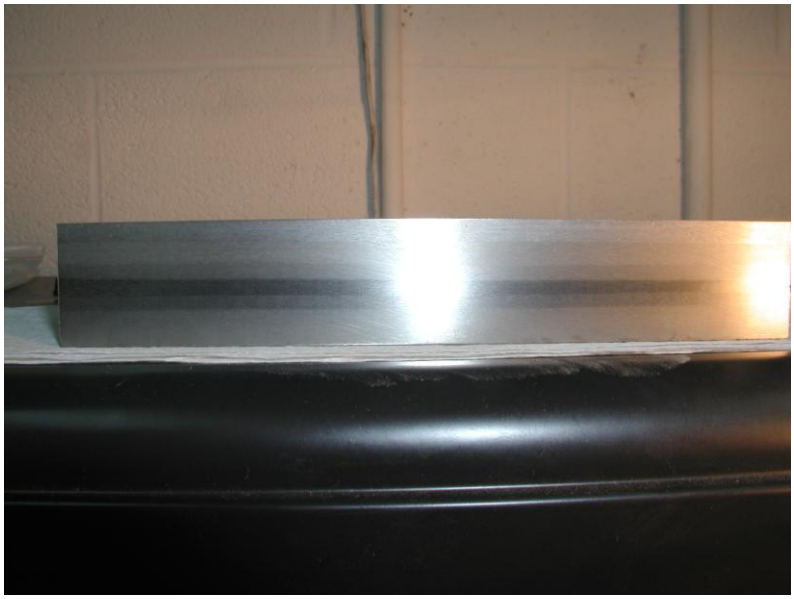
The test results showed the sensors all survived the extreme environment and accurately detected damage incurred by the TPS panel.

By monitoring and reporting any potential structural damage incurred to the TPS during launch, space flight, and reentry, the SHM system could potentially dramatically reduce turnaround time for vehicles such as the Space Shuttle and other reentry aircraft. The shuttle's current TPS system involves thousands of small tiles which must be glued to the vehicle individually. The tiles must be visually inspected and repaired after each flight, a time-consuming process that greatly increases time between launches. Mechanically-attached TPS panels, instead of tiles, used in conjunction with the SHM system could help eliminate this lag between launches.

Researchers will continue to analyze data gathered during the tests to determine optimum sensor configuration. The next round of testing, the Integrated Structures Ground Demonstration, will involve a fuel tank surrounded by TPS panels equipped with SHM sensors.

While SHM can likely benefit the ORS program, it can also be incorporated into other high-speed vehicles such as the F-16 to help monitor damage in-flight and help anticipate emerging structural problems.

AFRL researchers perform functionally-graded material (FGM) bending tests

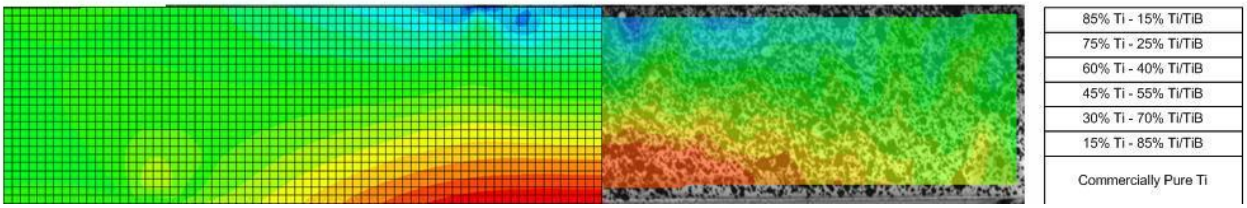


Profile of titanium/titanium boride FGM bend specimen.

AFRL researchers recently completed quasi-static bending tests of functionally-graded titanium/titanium boride test specimens in an effort to better understand the material-structure interactions and to evaluate laboratory testing tools and techniques.

The testing involved 6"X1"X1" specimens, some of the thickest titanium/titanium boride bend specimens ever produced. During the testing, each specimen was loaded in a four-point bending fixture in order to determine the stress, strain, and displacement fields on the specimens. To measure these quantities, experimental techniques such as differential thermography, digital image correlation, fiber optic strain gauging, and conventional, resistance strain gauging were employed. The testing validated the theory that FGMs can be tailored to improve the structural bending response. Furthermore, the testing gave AFRL researchers the opportunity to assess some of their more unique experimental tools when used in conjunction with complex material-structural geometries.

Functionally-graded materials such as the titanium/titanium boride composite have the potential to reduce or eliminate the need for parasitic thermal protection systems in hypersonic and other extreme environment aerospace vehicles. In other words, FGMs are another tool that designers could use to help maximize structural response and minimize weight in high-temperature aeronautical applications.



Overlay of strain fields using finite element analysis and digital image correlation for titanium/titanium boride FGM in four-Point bending.

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Air Vehicles News and Accomplishments

May 2007

Dr. Deborah Grismer was honored with the Federal Women's History Month STEM Role Model Award at a ceremony in Arlington, VA, on March 21.

Dr. Deborah Grismer presented with Science and Technology Role Model Award

Dr. Deborah Grismer of AFRL's Air Vehicles Directorate was recently presented the 2007 Federal Women's History Month Science, Technology, Engineering and Math (STEM) Role Model Award.

The STEM Role Model Award is presented annually, in conjunction with Women's History Month, to military and civilian women in the Department of Defense who epitomize the core values of their organization by providing exceptional leadership and seeking to create opportunities for other women and minorities in their field.

Dr. Grismer was presented the award at a ceremony held Wednesday, March 21 at the Women in Military Services for America Memorial in Arlington, Virginia.

"I was very surprised to have been chosen as the recipient of such a high-level award," Dr. Grismer says. "I'm very concerned about the decline in percentages of U.S. students pursuing science and engineering advanced degrees, so I try to point out to youth how enjoyable science and engineering careers can be."

Dr. Grismer is the Chief of the Control Design and Analysis Branch of AFRL's Air Vehicles Directorate. After earning her doctorate from the University of Notre Dame, she began her career as a military officer within AFRL

before becoming a civilian engineer in the Control Sciences Division. Since then, she has also served as a Deputy Division Chief, the Senior Technology Investment Planner, and Assistant to the Deputy Director of the Air Vehicles Directorate.

Lauded for her exceptional leadership skills, Dr. Grismer devotes much of her time to professional and personal volunteer efforts. She has recruited a number of female employees into AFRL and served as a leader in professional organizations such as the American Institute of Aeronautics and Astronautics. Additionally, she initiated the formation of the Female Scientists and Engineers group within AFRL.

Dr. Grismer has been a champion of diversity in the workplace, serving as the Division Lead of interactions with the Historically Black Colleges/Universities and Minority Institutions Program.

Additionally Dr. Grismer continues to serve as a mentor to the community, volunteering for a number of local and community organizations that seek to encourage female and minority students to enter STEM disciplines.

AFRL researchers earn award for international collaborative effort

A depiction of the high angle of attack vortex on an F-18 (left, photo courtesy National Research Council) and a photo of the piezoelectric actuators on the upper section of the vertical fin, as tested in the Defence Science and Technology Office (DTSO) International Follow-On Structural Test Project facility in Melbourne, Australia (photo courtesy DTSO).

An AFRL-led multi-national cooperative program team of researchers has recently been awarded The Technical Cooperation Program (TTCP) Team Achievement Award for their efforts toward developing a vibration suppression system that may extend the fatigue life of high-performance aircraft components.

The Next Generation Active Buffeting Induced Stress Suppression System cooperative program team included researchers from AFRL's Air Vehicles Directorate as well as participants from NASA and Boeing. The effort also involved research teams from Canada and Australia.

High-performance aircraft such as the F-18, F-22, and Joint Strike Fighter all encounter vortices while flying at a high angle of attack. These vortices create unsteady airflows which, in turn, cause oscillations in structural components and can lead to stress and damage.

The AFRL team's objective was to demonstrate an active control approach to the structural life extension problem on a shared technically-challenging problem. The team chose to investigate the application of an active buffeting alleviation system that reduces the oscillations, or buffeting, encountered on the F/A-18 vertical fin when flown at these high angles of attack.

The team sought to counter the harmful buffeting by applying active suppression using surface bonded piezoelectric actuators and incorporating the existing rudder hardware.

The piezoelectric actuators were specifically used to control the second vibration mode twisting motion that creates strain over the upper area of the vertical fin. Modeling is used to determine the most effective size and placement of the piezoelectric actuators on the fin in order to create the greatest benefit. Sensors detect the fin motion. A computer programmed control algorithm uses the sensor output to command the actuators to react to the movement of the fin countering the detrimental strain by applying an apposing strain.

The active rudder is used to counter the first fin vibration bending motion that places strain along the base. Sensors are used to detect the motion of the tail fin, and a computer programmed control algorithm determines the optimum rudder movement to counter the motion.

Together, the piezoelectric actuators and active rudder were able to stabilize the F/A-18 tail fin during simulated fin flight response conditions and potentially improve the fin's originally specified expected life from 7,500 flight hours to an estimated 12,000.

The hybrid buffet suppression system was tested on a full-scale F/A-18 vertical fin and fuselage structure at the Defence Science and Technology Office (DSTO) International Follow-On Structural Test Project facility in Melbourne, Australia. Results showed significant reduction in buffeting through the use of the system and demonstrated that the hybrid actuator system and each actuator system, individually offer a viable potential solution to buffeting or other vibration problems.

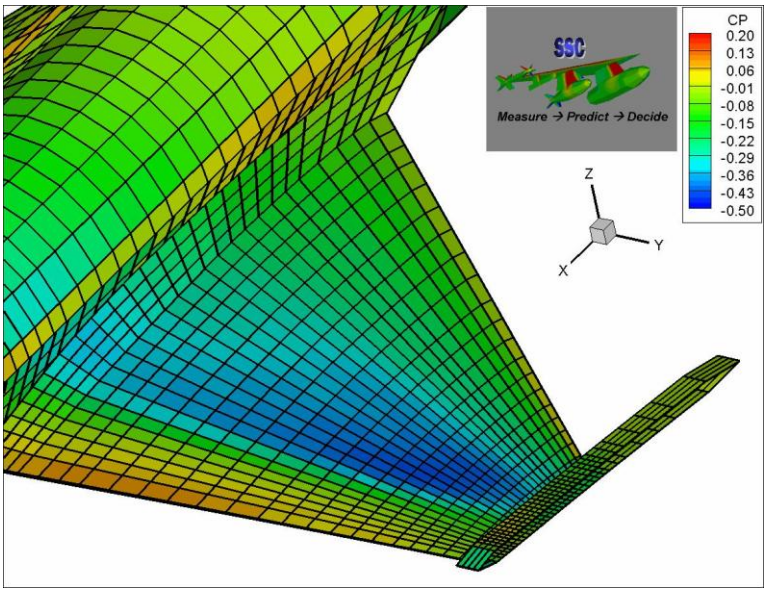
For their efforts, the team was awarded a prestigious TTCP achievement award, an honor presented annually for projects that best exemplify the intent of cooperative programs.

TTCP is an international organization that collaborates in defense scientific and technical information exchange. Member nations include the US, Canada, United Kingdom, Australia, and New Zealand.

Simulations tools to cut aircraft-stores certification costs

by Lt Col Philip Morgan, AFRL/VAAC
and 1Lt Alexis Nelson, AFRL/VASD

The Air Force SEEK EAGLE Office (AFSEO), located at Eglin Air Force Base, is the sole Air Force organization responsible for certifying the safe carriage of munitions, fuel tanks, pods, and other external stores attached to Air Force aircraft. To aid them in this important mission, the Air Force Research Laboratory (AFRL) has delivered to AFSEO the first of



three tools being developed to improve their simulation and modeling capabilities.

One may not expect anything catastrophic to happen to an aircraft by hanging a new weapon or other store from its wing; however, modern fighter and bomber wings are not completely rigid structures. During flight, the airflow interacts with the aircraft and the loaded stores, causing deformation of the wing structure. These dynamic interactions, called aeroelasticity, can lead to pilot disorientation, structural fatigue, and, in some cases, a catastrophic structural failure resulting in loss of the aircraft.

Snapshot of Dynamic Pressure Distribution on F-16 Wing in Transonic Flight

Thus, when a new store needs to be certified, AFSEO not only needs to verify the safety of the new store at different attachment locations on the wing, but also needs to investigate the thousands of possible flight condition and configuration combinations which result from the addition of this new weapon to existing stores. Obviously, predicting the aircraft response with confidence for all these situations is a difficult, time-consuming, and expensive job.

As if this task were not already daunting, it becomes more complex as an aircraft approaches the speed of sound, known as the transonic flight regime. In the transonic flight regime, non-linear flow physics become important and must be properly modeled for accurate numerical simulations. Current commercial-off-the-shelf (COTS) software tools use linear aerodynamic models that work well in the purely subsonic or supersonic portions of the flight envelope, but become unreliable in the transonic flight regime.

To overcome this limitation, the MEDium-Fidelity Flutter Analysis Tool (MEDFFAT) has been developed. MEDFFAT improves on COTS computer simulation approaches by including non-linear transonic effects in the aerodynamic model as well as tools to handle multibody store aerodynamics. Preliminary tests and validation have demonstrated that both of these capabilities provide significant improvements in solution accuracy for transonic flight simulations. The upgraded model has been integrated into an easy-to-use, customer-oriented tool that will help AFSEO in certifying safe stores carriage in this critical portion of the flight envelope.

The MEDFFAT software was delivered to AFSEO in December 2006. The software was developed by Lockheed Martin Aerodynamics Company and ZONA Technology Inc. under a contract with AFRL. The MEDFFAT program also involved significant collaboration with NASA, who consulted and provided tools for the transonic aeroelastic analysis of air vehicles without stores. The MEDFFAT solution process starts with defining the aircraft and store configuration to be studied. MEDFFAT then automatically generates the computational grid and simulates the dynamic aeroelastic interaction for steady flight and maneuvers. These results are then processed to provide information that can be used to make a safety assessment for the configuration. Flight tests are currently underway at AFSEO to validate MEDDFAT.

The MEDFFAT program is the first of three projects in the overarching Streamlined Stores Clearance (SSC) program that is aimed at improving AFSEO's modeling and simulation capabilities, ultimately allowing the Air Force to field new weapons faster. The second project of the SSC program, REal-TIme Nonlinear Analysis System (RETINAS), is currently under development. RETINAS provides real-time visualization of the flowfield and structural deformations during flight tests. The visualizations are based on MEDFFAT simulations performed prior to flight test.

Together, MEDFFAT and RETINAS transition technology developed by AFRL at the basic research level to represent the complex physics of aeroelastic systems through relatively simple real-time models.

Dr. Philip Beran, the AFRL SSC Product Manager, says, "It is gratifying to see basic research that leads to better capabilities for the Air Force's test and evaluation community. MEDFFAT was developed with the goal of reducing the number of flight tests AFSEO requires by 30%. Although we will never completely eliminate flight tests, based on our preliminary results we are very hopeful that we will reach our goal."

Dr. Charles Denegri, Lead Flutter Engineer at AFSEO, agrees, "We are glad AFRL is undertaking the Streamlined Stores Clearance program. A screening and simulation tool that accurately and quickly reproduces transonic flight regime flow characteristics will greatly enhance our stores clearance carriage process."

For more information on any of the stories contained in this report, please contact AFRL/VA Marketing at (937) 255-2074, DSN 785-2074, or e-mail AFRL/VA Marketing.

Air Vehicles News and Accomplishments

June 2007

AFRL-developed F-22 nose landing gear door decreases cost, maintenance

The re-designed F-22 Nose Landing Gear Door, now a part of all newly-produced F-22 aircraft.

AFRL researchers have developed an innovative nose landing gear door that will be a part of all newly-produced F-22 aircraft.

AFRL, as part of the Advanced Aluminum Aerostructures Initiative (AAAI), recently designed a revolutionary new landing gear door for the F-22. The new door will be less costly to produce and will significantly reduce maintenance time. The door has already been installed on two of the vehicles.

The redesigned nose landing gear door is a unitized structure, which eliminates the parts and fasteners typically required to hold door components together. This single-unit construction makes the door a more aerodynamically-efficient and easily-maintained structure.

Additionally, the door is fastened in place with snap-fit technology, meaning that it is composed of a lower grid section and a top skin. These parts snap together without the need for holes to be drilled. The elimination of holes means less potential for cracking.

Since the door is a one-piece structure, maintenance time and costs will be significantly reduced.

The AAAI program is an AFRL-managed, congressionally-funded advanced development program with the ultimate goal of reducing the installed cost of aluminum aerospace structures, while lowering maintenance requirements, improving performance, and reducing life-cycle costs.

AAAI represents a new approach to design, streamlining the design process by involving both the material manufacturer and the airframe manufacturer throughout all phases of product development.

AFRL's Plasma Acutation Team (from left to right): Dr. Donald Rizzetta, Dr. Datta Gaitonde, Dr. Miguel Visbal, Dr. Jonathan Poggie.

Plasma Actuation Team wins prestigious AFRL award

The Plasma Actuation Team of AFRL's Air Vehicles Directorate was awarded the prestigious Scientific and Technical Achievement Award at the AFRL Corporate Awards Banquet on February 28.

Comprised of Dr. Miguel Visbal, Dr. Datta Gaitonde, Dr. Jonathan Poggie, and Dr. Donald Rizzetta, the team seeks to unlock the physics for replacing traditional mechanical actuators with plasma actuators that provide flight control with no moving parts.

Plasma is a region of ionized air that occurs naturally under the extreme temperatures of hypersonic flight, or can be created artificially using an electric discharge. By manipulating the plasma with electromagnetic fields, plasma actuators alter the airflow over a vehicle, playing a similar role to a flap on a conventional aircraft's wing.

Plasma actuators can offer a variety of benefits over mechanical ones, including reduced weight and complexity. They can be operated with less power and can provide extremely rapid flight control adjustments in all speed regimes. This is a particularly attractive option in hypersonic flight.

Since plasma actuators are all-electric and contain no moving parts, they are significantly more reliable than traditional mechanical actuators. This high level of reliability can lead to a safer aircraft and reduced maintenance costs.

Plasma actuators can also improve the stealth qualities of aircraft. The surface-conformal design and the low heat signature can help make aircraft less detectable.

The Plasma Actuation Team is studying the use of plasma actuators for a number of vehicle applications, such as hypersonic vehicles, high-speed re-entry vehicles, high-altitude unmanned aerial vehicles (UAVs), and micro-UAVs.

In addition to military vehicles, plasma actuators may prove useful for commercial aircraft as well. The team's research is currently drawing interest from a number of organizations in industry and academia.

AFRL presents the Scientific and Technical Achievement Award annually to the team that has accomplished the most notable and distinctive in-house technical achievement.

VA scientists shine on the basketball court

Two AFRL Air Vehicles scientists recently participated as part of the Over Thirty Intramural League basketball championship team, proving that scientists can shine on the court as well as the laboratory.

Mark Derriso and David Stargel, both of the Air Vehicles Structures Division, played on AFRL #3 team, which emerged victorious in the March 26-27 league championship tournament. In fact, this year's victory is the fourth in a row for the successful team.

The team, made up mostly of personnel from AFRL's Air Vehicles, Materials, and Sensors Directorates, defeated teams from the National Air and Space Intelligence Center and the 88th Medical Group to advance to the finals. There, they faced the Headquarters Air Force Materiel Command team in a rematch of last year's championship game, winning by a score of 51-34.

According to Mr. Derriso, however, the wins are just part of the story. The real victory lies in the relationships formed along the way.

"We all work really well together, not just on the court, but off the court as well. Several of us collaborate on professional projects. We've formed really good relationships," Mr. Derriso says.

In fact, many of the team members have played together for three years or more which, according to Mr. Derriso, enhances the cooperative spirit. He says it also makes them better athletes.

"Winning this championship four years in a row says something about this team. It shows that not only do we work well together, but that good scientists and engineers can be good athletes, too," Mr. Derriso says.

The team's athleticism and commitment is apparent in their practice schedule. Many of the team members meet twice weekly at 6:30AM to work on their game. Although the team members are never able to practice all at the same time, the team's history of success clearly shows their togetherness on the court.

Team members say they aren't about stop now. They plan to be back to defend their title and go after a fifth championship in next year's tournament.

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AFRL researchers earn Perkins Award

Dr. Michael Oppenheimer and Dr. Michael Bolender received the Perkins award for their work in hypersonic modeling.

AFRL engineers Dr. Michael Oppenheimer and Dr. Michael Bolender of the Air Vehicles Directorate were recently awarded the Courtland D. Perkins award for their research in hypersonic vehicle dynamics and control modeling.

The researchers developed a new modeling capability that addresses some of the challenges controls engineers face when designing a hypersonic vehicle.

The modeling software developed by Dr. Oppenheimer and Dr. Bolender takes into account many of the unique aspects of hypersonic vehicles, such as the placement of the engine underneath the vehicle and the long, slender shape of the vehicle. Their model also considers the aeroelastic effects upon a hypersonic vehicle and the unsteady heat transfer effects experienced with hypersonic flight.

The goal of their efforts is to give engineers a tool they can use to analyze different hypersonic vehicle configurations and determine the controllability of each design. By using this tool, engineers can know up front what control issues they will experience with any given design.

The modeling capabilities developed by Dr. Oppenheimer and Dr. Bolender can be used to analyze and influence hypersonic vehicle designs well into the future and provide engineers with a valuable tool that was previously unavailable to them.

The model is currently being used not only by AFRL in-house researchers, but also by other governmental agencies, aircraft manufacturers, and academic institutions to conduct research into control law development for hypersonic platforms.

Future plans for the project include the addition of new capabilities to the modeling software. The researchers want to improve over the current longitudinal model by adding lateral directional dynamics, which would account for side-to-side and roll movements. They also want to look into the subsonic portion of the flight regime to determine what problems the vehicles encounter when transitioning to subsonic flight and attempting to land.

AFRL established the Dr. Perkins In-House Engineering Award in 1990 to perpetuate the spirit of excellence and innovation exemplified by Dr. Courtland D. Perkins. Dr. Perkins began his career as an entry level engineer for the Aircraft Laboratory at Wright Field and later became Assistant Secretary of the Air Force for Research and Development, Air Force Chief Scientist, Senior Scientist of the Air Force Scientific Advisory Board, and President of the National Academy of Engineering. This award honors the engineer or scientist making the most significant in-house contribution to aerospace technology.

AFRL engineers run 2007 ~~Country Music Marathon for charity~~

Amy Linklater and Scott Burns recently ran the Country Music Marathon, raising money for the Children's Tumor Foundation.

Two AFRL engineers recently took their love of sport to greater levels, participating in the 2007 Country Music Marathon and raising money for a worthy cause.

Aerospace Engineers Amy Linklater and Scott Burns used the marathon as an opportunity to raise money for the Children's Tumor Foundation, an organization they say is near to their hearts.

Through the help of family and friends, the pair managed to raise approximately $6000 for the organization, which helps combat neurofibromatosis, a disease that causes the growth of tumors on the body as well as other physical problems.

Linklater and Burns, both of AFRL's Air Vehicles Directorate, successfully finished the April 28 race with times of 4:52:21 and 4:10:47, respectively.

Both runners have been active in the sport for several years, participating in 10K events and half-marathons, as well Last Year's Flying Pig Marathon in Cincinnati. They say their decision to participate in the Country Music Marathon came from their desire to experience a new course in a new environment. Raising money for the charity also served as a motivation.

"It was nice to be able to help out the Children's Tumor Foundation while also doing something I really enjoy," says Linklater.

Linklater says the race itself went well, although the sun came out early into the race, making it very hot and difficult to run. The hilly course was also a challenge, but Linklater says the crowd and the bands along the course helped to motivate the runners. The course wound through parks and around lakes, providing a scenic view.

Overall, Linklater says she was very satisfied with the outcome of the race. She finished 14 minutes faster than her previous marathon run and had a great time doing it.

Linklater and Burns plan to continue pursuing their love of running. Linklater says she plans to run in the Troy Strawberry Festival 10K run this summer, and will likely run some half marathons in the fall. She may also try for a third marathon next spring if her schedule and training permit.

Future runs for charity may also be forthcoming. Linklater says she is planning to run a 5K this fall to benefit the Leukemia Foundation.

AFRL engineer earns President's Volunteer Service Award

Skip Gridley of AFRL's Air Vehicles Directorate was recently awarded the President's Volunteer Service Award for his involvement in the FIRST program.

AFRL Air Vehicles Directorate engineer Skip Gridley was recently presented the President's Volunteer Service Award, Gold Level, for donating over 500 hours of his time to a worthy cause.

Mr. Gridley, Air Vehicles Directorate Propulsion Integration Team Leader, was presented the award in April by the President's Council on Service and Civic Participation.

The President's Volunteer Service Award recognizes individuals, groups, and families who have donated a set number of hours of volunteer service throughout the year or over the course of a lifetime. The Gold Level Award recognizes adult individuals who have volunteered over 500 hours of service within a year.

As a recipient of the award, Mr. Gridley received a President's Volunteer Service Award pin, a certificate of achievement, a letter from the President of the United States, and a letter from the President's Council on Service and Civic Participation.

Mr. Gridley earned the award based on his participation in the FIRST LEGO League (FLL), a program designed for children ages 9 to 14, to spark an interest in science and technology. FIRST is an acronym that translates into For Inspiration and Recognition of Science and Technology. Each year, children who participate in the local, state, and national competitions build robots using LEGO components and demonstrate problem-solving and teamwork skills before a panel of judges.

Since first becoming involved in the competition in 2002, Mr. Gridley has served in many capacities such as judge, judge advisor, and referee.

Most recently, Mr. Gridley designed software to facilitate the judging process, aiding judges in scoring, timekeeping, and organization. He says his software is currently being used in competitions throughout the state of Ohio and will likely be used on a more widespread basis next year.

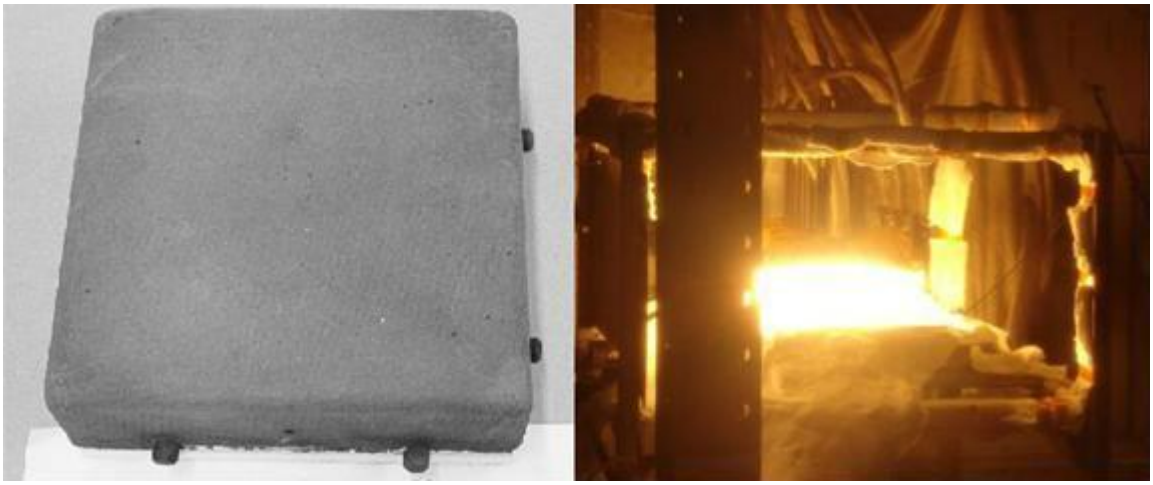
Mr. Gridley says he first became involved with FIRST through the Wright-Patterson Educational Outreach Office and staffer Kathy Levine, who leads the Ohio program, organizes tournaments and helps promote FLL throughout the state. He says he was motivated to participate in the program because he believes in the importance of promoting science at an early age.

"It's important for the country. It's obvious we need a scientific workforce for the future. Anything I can do to help that is great, and I have a lot of fun doing it," Mr. Gridley says.

Mr. Gridley says he will continue his volunteer work with FLL and plans to further refine his judging software next year.

"The FIRST LEGO League program is almost universally positive. It's a very rewarding activity for me, and I'll take any chance I have to help get students more interested in science and technology," Mr. Gridley says.

AFRL researchers test new Thermal Protection System (TPS) material



The aerogel-filled carbon foam/refractory composite shell test component, before the test (left), and during the test (right).

AFRL researchers recently tested an advanced TPS material that has potential applications for scramjet vehicles.

The aerogel-filled carbon foam and oxidation resistant composite structural shell component, which is being developed at AFRL's Materials Directorate under contract to Ultramet of Pacoima, Calif., was tested in the Air Vehicles' structural test facility.

The combination of aerogel-filled carbon foam with a refractory composite outer shell has the potential to structurally enhance a thermal protection system outer surface while providing the necessary thermal insulation to maintain the substructure at safe operating temperatures. State-of-the-art TPS found on the Shuttle orbiter comprises lightweight silica-based tiles that provide nothing to the structural performance of the airframe. The new concepts being developed by AFRL are pushing the technology toward more structurally- and thermally-efficient designs required by the Air Force to meet the rapid-turn requirements of future military systems.

During the testing, researchers used graphite resistance heating elements to heat the face of the TPS component to 3500 degrees Fahrenheit for three, five-minute cycles. The aerogel-filled carbon foam proved successful in reducing the cool-side temperature of the TPS component by nearly 2400 degrees Fahrenheit over a thickness of less than 1.5 inches.

The successful testing proved that the TPS component could maintain its integrity under the high temperature conditions while demonstrating very effective insulative capabilities.

The material could potentially be used for scramjet vehicles, as part of the engine flow path liner, to protect the lower temperature components of the vehicle from engine heat.

Air Vehicles News and Accomplishments

August 2007

Dr. Donald Paul (right) receives the Distinguished Alumni Award from the chairperson of the Michigan State University Mechanical Engineering Department, Eann Patterson.

Michigan State University honors Dr. Donald Paul with 2007 Mechanical Engineering Distinguished Alumni Award

AFRL Air Vehicles Chief Scientist Dr. Donald Paul was honored by the Michigan State University Mechanical Engineering Department with the 2007 Distinguished Alumni Award in a May 5 ceremony.

Dr. Paul, a 1968 graduate of the university, received the honor based on his professional and personal accomplishments and his ongoing support of the university.

After graduating from Michigan State, Dr. Paul went on to earn a master's degree in 1971 from the University of Southern California, and a doctorate in 1980 from Ohio State University, all in mechanical engineering.

After working as a materials research engineer at the Naval Weapons Center in China Lake, Calif., Dr. Paul joined the Air Force Flight Dynamics Laboratory (now the AFRL Air Vehicles Directorate) in 1971 as a research scientist and progressed to his current role as Chief Scientist.

Throughout his career, Dr. Paul has been a leader in advancing technologies. Much of his work has focused on exploratory and advanced developments in thermal structural analysis techniques and high-temperature structural concepts. He has served as the technical leader of the NASP Airframe Structures and Materials Team, where he was responsible for such advancements as the composite cryogenic tank, titanium metal and ceramic matrix composite structures, and actively and passively cooled leading edges. Additionally, he has served as the Air Force lead for the Technical Cooperation Program and the NATO Research Technology Organization, where he led the effort to solve aging aircraft structures problems.

Dr. Paul has been named a fellow in both the American Society for Mechanical Engineers and the American Institute of Aeronautics and Astronautics and has earned numerous awards, including the 2004 U.S. Presidential Meritorious Senior Professional Rank Award.

AFRL researchers complete Automated Aerial Refueling (AAR) simulation milestone

A view of the Automated Aerial Refueling simulation.

AFRL researchers recently completed a four-ship AAR storyboard simulation to exercise the AAR procedures, control algorithms, and simulation systems in an integrated, end-to-end test.

During the simulation, conducted May 9-10 in AFRL's Aerospace Vehicles Technology Assessment and Simulation (AVTAS) Laboratory, three experienced fighter pilots performed the duties of the air vehicle operator. Each pilot controlled the simulated flight of four unmanned aerial vehicles (UAV) through the aerial refueling process.

The simulation consisted of seven different scenarios all containing the following components: rendezvous, air refueling procedures, repositioning receivers around the tanker, and post-refueling procedures. Additionally, some of the scenarios contained one of the following contingency procedures: rendezvous overrun, breakaway, or discontinuation of air refueling.

Three different types of rendezvous, point-parallel, enroute, and fighter turn-on, were used throughout the study. A point-parallel rendezvous consists of the tanker aircraft turning in front of the receiver aircraft by approximately 1-3 nautical miles. An enroute rendezvous consists of the tanker and receiver aircraft meeting at a predetermined location at a predetermined time. A fighter turn-on rendezvous consists of the receiver aircraft maneuvering to rollout behind the tanker.

All three pilots rated the scenarios as a low-workload task and did not foresee any problems with the AAR Storyboards or the air vehicle operator station.

The simulation represents another step forward in moving AAR technology toward an operational capability. Future plans for the program include a Fall 2007 flight test, during which the AAR team will demonstrate the ability of a UAV surrogate to move autonomously around the tanker and then move into refueling position at the direction of a controlling computer. A graduation four-ship storyboard assessment simulation is scheduled for late Fall 2007.

The purpose of the AAR program is to develop and demonstrate the capability to perform boom & receptacle refueling of UAV systems with the existing Air Force tanker fleet using operationally representative subsystems.

Larry Byram is the 2007 recipient of the Air Force SBIR Manager of the Year award.

Larry Byram named Air Force SBIR Manager of the Year

AFRL Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Program Manager Larry Byram was presented the Air Force SBIR Manager of the Year award on May 14, 2007, at the Department of Defense SBIR/STTR Annual Workshop in New Orleans.

The award is presented to the SBIR program manager who best exemplifies a spirit of excellence and professionalism in his or her service to the Air Force SBIR program.

Mr. Byram has served as the AFRL Air Vehicles SBIR Program Manager for the past year and a half. In that time, he established a SBIR contracting process between VA and the directorate's contracting division that reduced VA's time for getting awards on contract by three weeks. He also took on the process of creating a six part folder containing initial paperwork for the program managers, thereby saving them considerable time and effort. Mr. Byram excels at keeping VA's SBIR funds balanced with the SBIR records of AFRL and the Air Vehicles Directorate's Financial Management division. Mr. Byram's technical, organizational, and leadership abilities have made him particularly qualified for this honor.

"From where I sit, Larry has been able to bring the VA SBIR program up to the next level. He constantly takes what he learns and extrapolates and applies it to VA. He is a joy to have as one of the AF SBIR team members because he exemplifies the 'Gung Ho!' attitude we espouse in all our members," says Stephen Guilfoos, Air Force SBIR/STTR Program Manager.

VA secretaries honored at Secretary of the Year Awards

Two Air Vehicles Directorate secretaries were honored for their outstanding contributions during the 30th annual Secretary of the Year Awards Luncheon.

Cindy Consani (AFRL/VA) and Martha Hall (AFRL/VAC) were presented with the Small Team Award during the ceremony, held April 20 at the Wright-Patterson Club.

Maj Gen Ted F. Bowlds was the guest speaker for the ceremony, and Base Commander Col Colleen M. Ryan presented the awards.

The Secretary of the Year Awards Luncheon is sponsored by the Wright-Patterson Secretary

Cindy Consani and Martha Hall (at left) pose with Base Commander Col Colleen M. Ryan and the other award winners at the Secretary of the Year Awards luncheon.

Advisory Council to recognize secretaries base-wide and honor the contributions they make every day to their organizations.

According to Brian Van Vliet, Deputy Director of the Air Vehicles Directorate, Ms. Consani and Ms. Hall have been indispensable to the organization.

“These ladies are invaluable members of our team. The support we receive from them, as well as from the administrative staff throughout the directorate, is essential in achieving our mission,” says Mr. Van Vliet.

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Air Vehicles News and Accomplishments

September 2007

AFRL’s Cooperative Operations in UrbaN TERrain (COUNTER) program participates in combined US-Australia exercises

AFRL’s Cooperative Operations in UrbaN TERrain (COUNTER) program recently participated in the Talisman Saber 2007 exercise, the largest joint warfighting exercise in the Pacific.

The COUNTER project is an effort designed to provide situational awareness to special operations forces in an urban environment. The COUNTER team uses small and micro Unmanned Air Vehicles (UAVs) to perform surveillance and collect video telemetry to detect possible threat targets in an urban environment. The COUNTER technology enables a single operator to manage multiple small and micro UAVs in low altitude tactical (Urban) environments.

The COUNTER Talisman Saber team displays some of the UAVs and equipment that make up the COUNTER system.

The Talisman Saber exercise is designed to train Australian and US combined forces in mid- to high-intensity combat operations and to ensure the cooperative readiness of the forces. The Pacific Command (PACOM) was particularly interested in assessing the COUNTER program’s ability to help close gaps related to unmanned vehicles and urban operations.

During the exercises, the COUNTER team became integrated with Australian Defense Forces, PACOM, and the 3rd US Marine Expeditionary Forces who filled the role of the Opposition Forces (OPFOR). The COUNTER team served as the only aerial reconnaissance assets available to OPFOR.

The COUNTER team deployed three UAVs for Intelligence, Surveillance, and Reconnaissance. The UAVs flew over 40 sorties in support of the OPFOR.

The COUNTER UAVs flew alongside other manned vehicles during the exercise, presenting a challenge in planning and executing the sorties. Additionally, the team had to perform radio frequency and GPS jamming deconfliction while compensating for real-time changes in enemy and friendly force activity.

The COUNTER system performed all tasks successfully and demonstrated that the technology could be used effectively in an actual combat scenario.

The team's participation in the exercises expanded the operational envelope of the COUNTER system, since the components of the COUNTER system were used in missions beyond their design specifications. The team also gained increased experience and knowledge of new techniques and tactics as a result.

Talisman Saber 2007 marked AFRL's first major participation with PACOM. AFRL's participation in the exercise directly demonstrates and combines the three Air Force Core Competencies: Developing Airmen, Technology-to-Warfighting, and Integrating Operations. COUNTER was one of four AFRL technologies to participate in Talisman Saber.

The X-48B Blended Wing Body research vehicle, on its maiden flight at the NASA Dryden Flight Research Center.

X-48B Blended Wing Body test vehicle takes flight

The X-48B Blended Wing Body (BWB) research vehicle, developed by AFRL, Boeing, and NASA, made a successful maiden flight July 20, at the NASA Dryden Flight Research Center in Edwards, Calif.

The test aircraft, an 8.5 percent scale, remotely piloted vehicle, successfully completed a 31-minute flight, which tested the revolutionary aircraft's handling and flying capabilities.

The BWB design is similar to a flying wing, but the aircraft's fuselage is triangular-shaped. The triangular fuselage gives the aircraft increased lift and less drag over the traditional tube-shaped fuselages of most military and commercial aircraft.

The BWB concept provides greater fuel efficiency and increased cargo or passenger capacity. The aircraft may also prove to be quieter, since the engines are mounted on the back of the aircraft, away from the fuselage.

During the maiden flight, in which the aircraft climbed to an altitude of 7,500 feet, the BWB test vehicle completed a number of successful tests, including initial stability checks, auto throttle checks, and a practice landing and approach at altitude. Data from the test flight was compared to the extensive wind tunnel data collected during numerous tests at the Langley Full Scale Tunnel operated by Old Dominion University at Langley Air Force Base.

All tests during the flight were completed successfully, and the aircraft passed a post-flight inspection with no parts damaged. The remote pilot reported that the aircraft handled and flew well.

After initial evaluation and adjustments, the aircraft was expected to make additional test flights. Up to 25 test flights are planned at the low-speed flight regime to gather data and further evaluate the configuration.

Because of its unique shape and cargo capacity, the BWB concept has many potential commercial and military applications, including as a tanker or transport aircraft.

AFRL researchers complete Blended Wing Body (BWB) wind tunnel testing

The Blended Wing Body model in the Arnold Engineering Development Center's 16-foot transonic wind tunnel.

AFRL researchers completed wind tunnel testing of the BWB in Arnold Engineering Development Center's (AEDC) 16-foot transonic wind tunnel (16T).

This testing of the BWB model was a follow-on to previous wind tunnel testing, conducted last year in the National Transonic Facility (NTF). The larger cross-section of the AEDC wind tunnel allowed researchers to gather a broader range of data and measure the model at higher Mach numbers than in the previous tests.

Over 250 data runs were made covering 23 configurations over a Mach number range of 0.5 to 0.97. The initial portion of this test was conducted at the same conditions as the NTF test to provide a direct data comparison. The remainder of the test was conducted at a lower tunnel air pressure, which is less expensive, to permit testing more configurations under the available budget.

Researchers were particularly interested in investigating Mach tuck and Mach buffet on the configuration. Mach tuck is a condition in which the nose of the aircraft tends to pitch downward as the airflow around the wing reaches supersonic speeds. Mach buffet is a condition in which the wings begin to vibrate at supersonic speeds. Initial data showed that neither Mach tuck nor Mach buffet was observed during the testing.

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Air Vehicles News and Accomplishments

October 2007

The tip tanked configuration in flight over Central Ohio.

AFRL researchers perform C-130 tip tank tests

AFRL researchers, in conjunction with Snow Aviation, recently performed tests on a modified C-130E aircraft fitted with functional tip tanks, eight-bladed NP2000 propellers, and extended dorsal and rudder surfaces.

The purpose of the testing was to determine the effects of adding the tip tanks to the aircraft that had already been modified to include the improved propellers and extended aerodynamic surfaces and to measure the impacts of the tip tanks on flight characteristics.

Tip tanks are fuel tanks mounted at the end of the wings. These tanks would potentially replace traditional fuel tanks on the C-130 and may help improve aileron effectiveness and reduce the configuration's drag, allowing it to be more fuel efficient while at the same time adding fuel capacity.

During the testing, which took place from early March to mid-May and involved multiple flights, researchers measured the impacts of the tip tanks on the stall speed, minimum controllable air and ground speeds, cruise ceiling, specific range, wing bending, drag, takeoff and landing distances, and aileron effectiveness. The data were compared to those collected during recent C-130 baseline testing, conducted in Fall 2006.

Using Snow Aviation’s onboard instrumentation suite, the tests of the modified aircraft showed 15% improvement in takeoff and landing distances, 10% improvement in the aircraft’s stall speed, 5% improvement in minimum controllable speeds, 500’ increase in ceiling, 5% increase in specific range, and 50% reduction in audible range in comparison with a “stock” C-130E aircraft.

The experimental results will be transmitted to the user community, including Air Force Special Operations Command, Air Mobility Command, and the C-130 System Program Office, to increase their knowledge of these technologies.

A follow-on project will involve further tests, to be conducted with improved fuel measurement and pressure sensing devices, to help researchers get a more precise look at the impacts of the tip tanks, propellers and extended aerodynamic surfaces.

The tip tank effort is one in a line of several C-130 modifications by Snow that are designed to improve the aircraft's short take off and landing performance and controllability and may also have the impact of improved fuel efficiency.

ISHM conference highlights vehicle health management issues

The AFRL booth at the ISHM conference featured video displays and posters encompassing elements of Integrated Systems Health Management: Flight Controls Health Management, Engine Health Management, Electrical Power Health Management, and Structural Health Management.

The Air Vehicles Directorate participated in the annual Integrated Systems Health Management (ISHM) Conference, held August 6-9, at the Millennium Hotel in Cincinnati. The conference is the largest in the ISHM field.

Chaired by AFRL Air Vehicles engineer Mark Derriso, the ISHM conference serves as a forum for collaboration among health management community experts. The conference gathers experts throughout government, industry, and academia to share ISHM research and discuss technological breakthroughs.

ISHM is a term applied to a system that collects data from various areas of an aircraft and transmits real-time information about the condition of the vehicle back to the maintenance depot. This instant information helps flight support personnel know if a problem arises with the aircraft and helps them predict when it will need maintenance or repair. ISHM enhances vehicle safety and provides benefits in terms of cost and vehicle availability.

This year's ISHM conference was attended by 165 people and featured exhibits from organizations such as NASA, the University of Cincinnati, and AFRL. Many local and national companies also displayed exhibits, many of which featured demonstrations of their emerging technologies.

Over 30 presenters discussed health management research as it pertains to Enabling Technologies, Sub-System Applications, and Platform Implementations.

The keynote speaker for the ISHM conference was Dr. Steven Rogers of AFRL's Sensors Directorate. Dr. Rogers, who specializes in the areas of Auto Target Recognition and Sensor Fusion, delivered a presentation titled, "Is it possible to create a vehicle that feels?"

"This year's ISHM conference opened our view as to what other agencies in our area are doing to advance ISHM technologies," says Mr. Derriso.

According to Mr. Derriso, the conference also opens up opportunities for collaboration among the technical directorates within AFRL as well as with the Navy and Army.

The next ISHM conference is scheduled for August 2008. Next year's conference will feature an expanded exhibit hall with more interactive exhibits, which proved to be popular this year.

In addition, the 2008 ISHM conference will provide training classes for attendees. These training classes will be designed to help attendees develop a better understanding of health management technologies and establish a uniform vocabulary among organizations.

For more information on any of the stories contained in this report, please contact AFRL/VA Marketing at (937) 255-2074, DSN 785-2074, or e-mail AFRL/VA Marketing.

Air Vehicles News and Accomplishments

November 2007

Automated Aerial Refueling team completes Positions and Pathways Flight Test

By Dan Schreiter, AFRL/RBCC

On 12 September 2007, the Air Force Research Laboratory Air Vehicles Directorate completed its Automated Aerial Refueling (AAR) Positions and Pathways Flight Test. This series of flights demonstrated the ability of the AAR system to autonomously execute all aerial refueling maneuvers in close formation around a tanker and to execute practice breakaways. A Learjet, acting as a surrogate unmanned refueling receiver aircraft, used the AAR system to track the tanker's flight path, position itself in a trail formation, fly up to the tanker, and adjust its position among the observation, pre-contact, and contact refueling positions.

A Learjet, acting as a surrogate unmanned aerial vehicle, flies autonomously in formation behind a KC-135R tanker during a recent Automated Aerial Refueling flight test.

The purpose of the AAR program is to develop and demonstrate the capability to perform boom & receptacle refueling of Unmanned Air Vehicle (UAV) systems with the existing Air Force tanker fleet using operationally representative subsystems. AAR will benefit UAV operations by increasing combat radius and mission time, reducing response time for time-critical targets, reducing need for forward staging areas, and increasing in-theater presence. The Positions and Pathways Flight Test integrates components on both the tanker and receiver aircraft to demonstrate the ability for the receiver aircraft to autonomously hold position relative to the tanker and fly formation transitions while the tanker executes its standard maneuvers.

During the 10th and 12th September 2007 flights, the Learjet was manually flown to the transition point behind a KC-135R from the 107th Air Refueling Wing of the New York Air National Guard. The Learjet then engaged the AAR system, which autonomously flew the Learjet to the observation position on the tanker wing. From there it was directed from a control station to fly to the pre-contact and contact positions after approval by the tanker crew. During the flights, the AAR system was engaged for over one hour and 40 minutes and held formation at the contact position for 19.2 consecutive minutes. During the September 12th flight, the Learjet followed the KC-135 through two complete refueling orbits. Throughout the Positions and Pathways Flight Test, the Learjet was engaged for over eight hours in the vicinity of the tanker.

In addition to demonstrating the proper flight characteristics for a refueling receiver, the AAR team continues to make strides toward preparing AAR technology for transition to production systems. Advances in system

integrity, continuity, and availability were achieved through improved relative navigation algorithms, control laws, and hardware, and these improvements were validated in flight.

Over the next few years, the AAR team will build upon the success of the Positions and Pathways Flight Test toward enabling automated refueling capabilities. During AAR Phase Two, the team will demonstrate a complete AAR capability by autonomously performing a refueling including the delivery of fuel to the receiver. Also, multi-ship and autonomous refueling operations in a GPS-denied environment will be matured. Simulations of both multi-ship operations around the tanker and long distance tanker rendezvous will support further AAR development and accelerate transition from the surrogate receiver test bed to Air Force assets.

The AAR team includes a diverse set of government and contractor organizations. The government team includes the Air Force Research Laboratory Air Vehicles, Sensors, Human Effectiveness, and Information Directorates at Wright-Patterson AFB, the Air Force Flight Test Center and Air Force Test Pilot School at Edwards AFB, Naval Air Systems Command (NAVAIR), the 107th Air Refueling Wing New York Air National Guard at Niagara Falls, 827th Aircraft Sustainment Group at Tinker AFB, DARPA Information Exploitation Office, Aeronautical Systems Center, Air Mobility Command, and Air Combat Command. On the contractor side of the team, Calspan operates the Learjet; Rockwell Collins supports KC-135 operations, builds the Tactical Targeting Network Technologies datalink, and builds the GPS receiver; L3 Communications, SySense and the Illinois Institute of Technology work with NAVAIR developing the precision global positioning system based relative navigation system; Boeing built the AAR flight control computer and developed the station keeping control laws; Northrop Grumman built the integrated INS/GPS inertial navigation system, designed relative navigation software, and developed an EO/IR position sensing system. General Dynamics Advanced Information Systems provides systems engineering and flight test management assistance; Syngenics coordinates the AAR trade studies; Bihrle Applied Research integrates simulations environments; West Virginia High Technology Consortium develops image processing algorithms; and Coherent Solutions developed the required navigation performance.

Three Air Vehicles scientists receive Air Force research and development awards

Capt Nidal Jodeh

Capt Scott Bjorge

Trenton White

Capt Nidal Jodeh, Capt Scott Bjorge and Trenton White of the Air Force Research Laboratory Air Vehicles Directorate were recently awarded Air Force Science & Engineer and Science & Technology awards.

Capt Jodeh of the Control Design and Analysis Branch received the Air Force Research and Development Award for his work on the Cooperative Operations in UrbaN TERrain (COUNTER) project. The COUNTER project is an effort designed to provide situational awareness to special operations forces in an urban environment using small and micro unmanned aerial vehicles to perform intelligence, surveillance, and reconnaissance. COUNTER technology enables a single operator to manage multiple small and micro unmanned aerial vehicles at low altitudes simultaneously. Capt Jodeh is a recent recipient of the AFRL Air Vehicles Directorate Scientific and Technical Management Award.

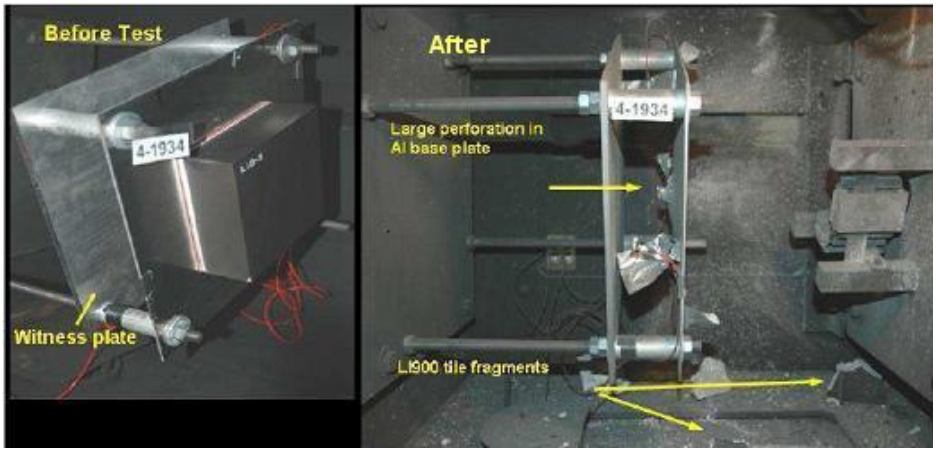
Capt Bjorge of the Analytical Mechanics Branch was awarded the Outstanding Scientist Award (Junior Military) for his service as the deployment lead on the AngelFire program. AngelFire is an innovative airborne surveillance system that detects and tracks improvised explosive devices and ambushes in densely populated urban areas in near real-time. Capt Bjorge aggressively led the enhancement and transition of the AngelFire system for immediate deployment in support of Operation Iraqi Freedom. He personally deployed to the Iraq combat zone to survey the operating area and coordinate system requirements with users from ground-based tactical units of the United States Marine Corps. Capt Bjorge is the recipient of the Outstanding Unit Award (1 oak leaf cluster), the Air Force Commendation Medal, and the Air Vehicles Technical Team Award.

Trenton White of the Aerodynamic Configuration Branch received the Air Force Outstanding Scientist Award (Junior Civilian). As a member of the Low Speed Configuration Team, Mr. White has researched ways to equip the C-130 transport aircraft with tip tanks, improved propellers, and other modifications designed to improve fuel efficiency as well as takeoff, landing, and low speed performance. Mr. White is also the program manager for several Small Business Innovative Research contracts that are performing research in the high altitude, long endurance flight regime. He is a key member of the Air Vehicles Quantitative Technology Assessment team where he performs analysis on conceptual aircraft to determine where potential Air Force investments will produce the greatest impact in terms of capability. In addition to this most recent honor, he was also named the AFRL Civilian of the Quarter for the first quarter, 2007.

The award recipients were honored at a banquet on October 4, 2007, at the United States Air Force Academy.

AFRL Thermal Protection System (TPS) tests validate thermal tile designs

AFRL recently conducted a series of TPS tests aimed at determining the performance and durability of various TPS concepts under extreme environmental conditions. Researchers are developing TPS concepts that involve wrapping various Ceramic Matrix Composite (CMC) materials around silica insulating tiles to improve the tile durability and lower the maintenance requirements.



Baseline shuttle TPS tile, before and after projectile impact testing.

The first set of tests was a Micro Meteoroid Orbital Damage (MMOD) test, conducted at the University of Dayton. The MMOD test evaluated oxide and non-oxide CMC-wrapped tiles to see which performed best under projectile impacts of seven kilometers per second.

The MMOD tests revealed that high density (14lb/ft3) tiles with an oxide-CMC wrap or Carbon-Silicon Carbide (C/SiC) wrap performed best, with the C/SiC wrapped-tiles completely shattering but leaving the base plate (representing the surface of the vehicle skin) completely undamaged. Unwrapped tiles, similar to some used on the space shuttle, were tested to provide baseline measurements but failed to provide adequate damage protection, leaving a one-inch hole in the base plate. All wrapped tiles tested outperformed the baseline tiles.

A second set of tests was conducted in AFRL's Combined Environmental Acoustic Chamber (CEAC). These tests evaluated the performance of the similar wrapped tiles under simulated launch and re-entry thermal and acoustic conditions.

During the CEAC tests, an array of eight wrapped tiles was subjected to thermal conditions from 800° F to 2300° F and acoustic levels up to 165 decibels. The array included an unwrapped tile (serving as a control), two C/SiC wrapped tiles, and five oxide tiles. Test results showed that the oxide tiles performed best, with no delamination or loss of tile faces.

Overall results of the series of tests indicate that CMC-wrapped oxide tiles performed the best under all simulated environmental conditions. CMC-wrapped tiles represent an attractive option for TPS because the outer covering is very durable, while the foam interior is lightweight.

Data from this series of tests will be compiled into a final report and used to continue the TPS research. Ultimately, the project's goal is to offer a durable, low-maintenance TPS concept for future re-entry vehicles.

For more information on any of the stories contained in this report, please contact AFRL/RB Marketing at (937) 255-2074, DSN 785-2074, or e-mail AFRL/RB Marketing.

Air Vehicles News and Accomplishments

December 2007

Opportune Landing Site (OLS) testing proves successful

The AFRL-managed OLS program recently underwent two successful landing site soil tests.

OLS software, jointly developed by Boeing and the US Army's Cold Regions Research & Engineering Laboratory (CRREL), uses satellite imagery, Digital Terrain Elevation Data, and Air Force Weather Agency data to help find suitable landing sites for aircraft. The software analyzes the terrain's width, length, and flatness, and determines

Members of the Air Force Civil Engineering Service Agency collect soil samples from terrain chosen by the OLS software during recent tests.

whether the terrain is free of vegetation, standing water, and obstructions.

During the first round of tests, conducted at Vandenberg Air Force Base, the Air Force Civil Engineering Service Agency (AFCESA) collected soil samples of terrain that had been chosen by the OLS software. The soil was then analyzed and compared to the OLS system data.

The analysis of the soil samples showed that Boeing's OLS software model accurately predicted the soil type down to 30 inches. In addition, soil strength estimations provided by CRREL were also found to be extremely accurate.

Additional testing, conducted at Holloman Air Force Base, confirmed the Vandenberg results. Although the actual soil type did not match the predicted soil type, the OLS system again reliably predicted soil hardness at the two opportune landing sites tested by AFCESA.

OLS software could potentially be used in conjunction with other analysis methods, to help pilots land aircraft in natural terrain, thereby increasing the capabilities of mission-critical vehicles such as transport aircraft. The software could potentially open up a wider array of landing options for military aircraft, saving time and money.

The OLS program is funded under the USTRANSCOM Technology Transformation Initiative and directed by Air Mobility Command. SynGenics and General Dynamics Advanced Information Systems provide systems engineering support for the program.

Dr. Datta Gaitonde of the Air Vehicles Directorate was recently named a 2007 AFRL Fellow.

Dr. Datta Gaitonde named 2007 AFRL Fellow

Dr. Datta Gaitonde of the Air Vehicles Computational Sciences Branch is one of seven people recently named a 2007 AFRL Fellow.

Dr. Gaitonde received the prestigious honor because of his work in the field of hypersonics. He currently serves as the Technical Area Leader of the High-Speed Flows Group. His work in computational research has greatly improved the understanding of hypersonic flight, allowing researchers to go beyond the limits of physical testing and traditional computer simulations. Through his work, Dr. Gaitonde has established himself as AFRL's leading expert in computational hypersonics.

Dr. Gaitonde holds a bachelor's degree in mechanical engineering from the Indian Institute of Technology in Bombay, India, and master's and doctorate degrees in mechanical and aerospace engineering from Rutgers University. He began his work in the laboratory as a visiting scientist and became an AFRL employee in 1997.

Dr. Gaitonde has authored over 150 technical articles and four book chapters. In addition to being an Associate Editor of the American Institute of Aeronautics and Astronautics (AIAA) Journal, he is a reviewer for major archival publications in his field and has served as organizer and session chair at numerous international meetings and symposia.

In addition to his publications, Dr. Gaitonde is also an Associate Fellow of AIAA, a member of the American Society of Mechanical Engineers, and a member of the American Physical Society (APS), where he has served

on the Frankiel Award Committee. He is a recipient of the Affiliated Societies Council outstanding scientist award, AIAA outstanding technical contribution award, the APS Gallery of Fluid Motion prize, the AFRL team scientific and technical achievement award, and the Gen Benjamin D. Foulois award.

The AFRL Fellows Program is designed to recognize and reward AFRL's most outstanding in-house scientists and engineers. The recipients of the award are selected for their exceptional performance and individual stature in their fields of study.

Dr. Jonathan Poggie named 2007 American Society of Mechanical Engineers Fellow

Dr. Jonathan Poggie of the Computational Science Branch has been named a 2007 American Society of Mechanical Engineers (ASME) Fellow.

Dr. Jonathan Poggie of the Air Vehicles Directorate Computational Science Branch was recently named a 2007 American Society of Mechanical Engineers (ASME) Fellow.

Dr. Poggie received the honor based on his experimental work on hypersonic boundary layer transition and computational work on plasma actuators for hypersonic flow control. His research has greatly enhanced the understanding of hypersonic aerodynamics.

After earning his bachelor's degree in mechanical engineering from the University of Rhode Island, Dr. Poggie continued his studies in mechanical and aerospace engineering at Princeton University under a National Science Foundation Graduate Research Fellowship and, later, under the USAF Senior Knight program. He graduated in 1995 with a doctorate in mechanical engineering.
Dr. Poggie began working at AFRL in 1995, in what is now the Air Vehicles Aerodynamic Configuration Branch, doing basic experimental research in hypersonic boundary layer stability and transition. He then shifted his research focus to computational plasma dynamics. He now works in the Computational Sciences Branch, where his primary research areas are computational hypersonics and plasma discharge actuators for high-speed flow control.

In addition to this most recent honor, Dr. Poggie has also been awarded the 2007 AFRL Team Scientific and Technical Achievement Award, the 2006 American Institute of Aeronautics and Astronautics (AIAA) Dayton-Cincinnati Section Outstanding Technical Contribution Award, and the 2006 AFRL Air Vehicles Directorate Benjamin D. Foulois Award for Basic Research. Additionally, Dr. Poggie has also been named an AIAA Associate Fellow. He has authored 16 peer-reviewed articles and three book chapters.

ASME awards fellowships to members who have demonstrated significant engineering achievements and contributions to the engineering profession.

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